

100

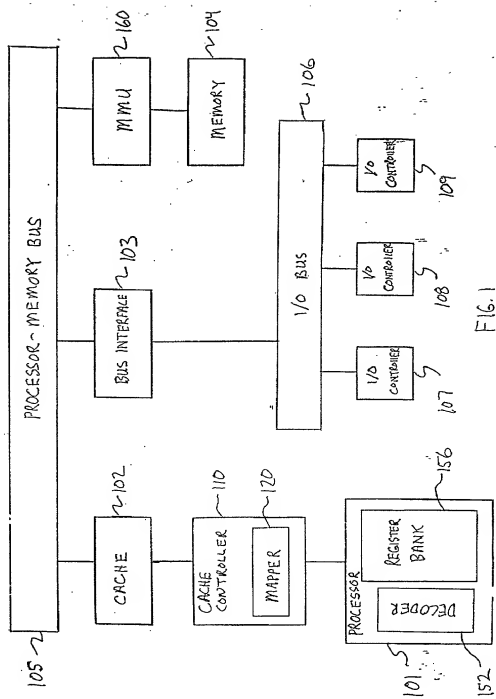


FIG. 1

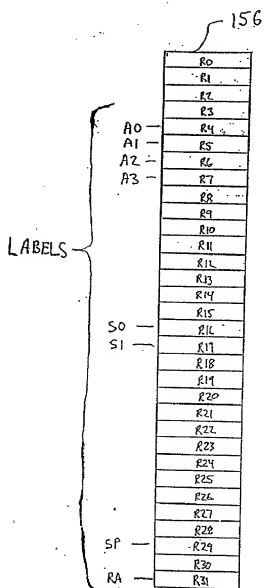


FIG. 2

104

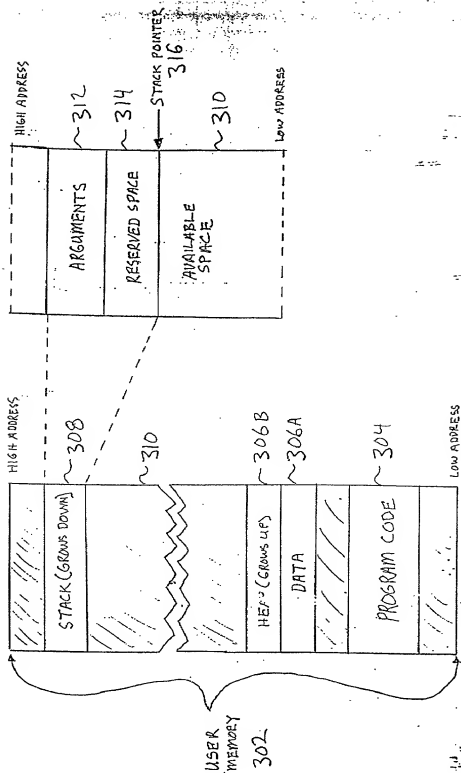


FIG. 3

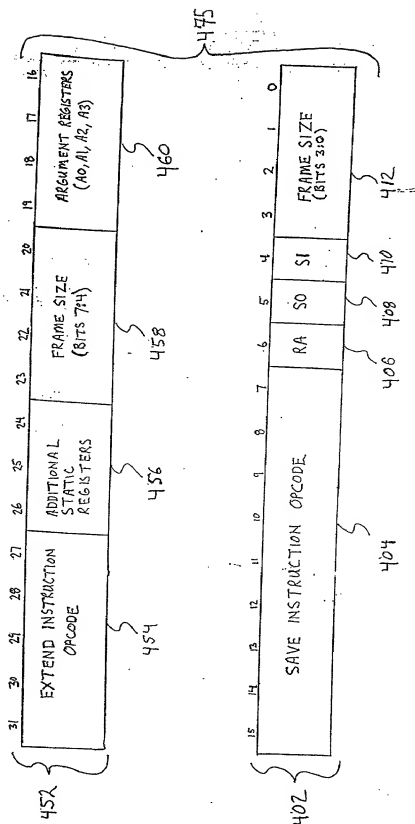


FIG. 4

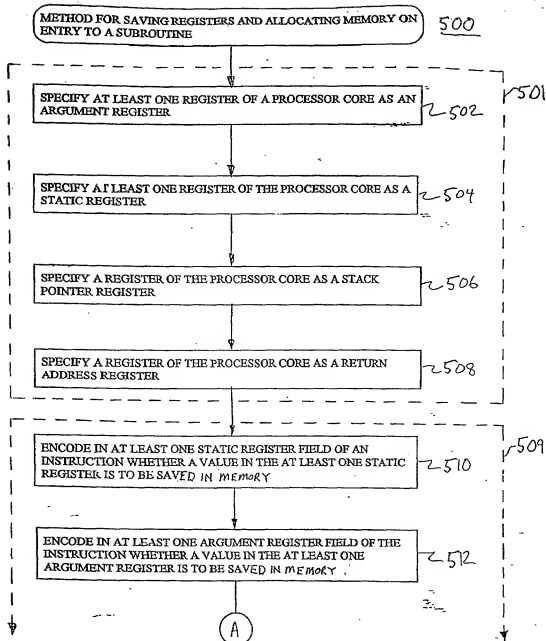


FIG. 5A

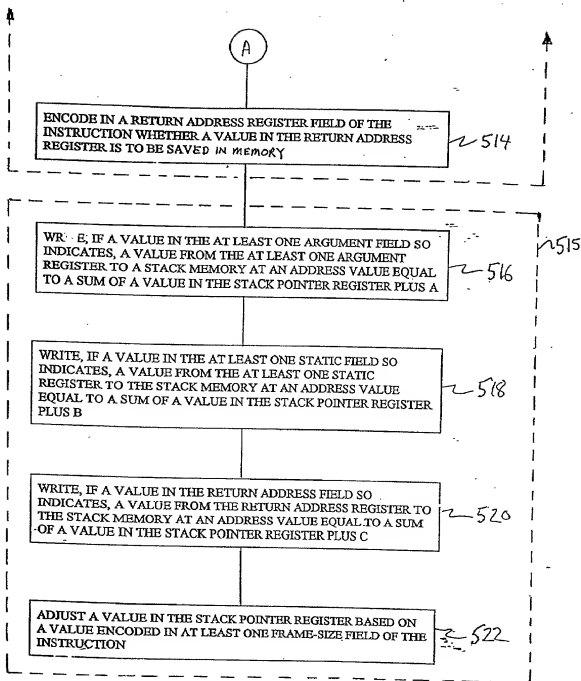


FIG. 5B

## SAVE INSTRUCTION

```
temp ← GPR[29]
if ra = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[31]
endif
if sl = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[17]
endif
if s0 = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[16]
endif
if framesize = 0 then
    temp ← GPR[29] - 128
else
    temp ← GPR[29] - (0 if (framesize << 3))
endif
GPR[29] ← temp
```

FIG. 6

| <i>args</i><br>Encoding<br>(binary) | Registers Saved as<br>Arguments | Registers Restored as StaticRegisters |
|-------------------------------------|---------------------------------|---------------------------------------|
| 0000                                | None                            | None                                  |
| 0001                                | None                            | GPR[7]                                |
| 0010                                | None                            | GPR[6], GPR[7]                        |
| 0011                                | None                            | GPR[5], GPR[6], GPR[7]                |
| 1011                                | None                            | GPR[4], GPR[5], GPR[6], GPR[7]        |
| 0100                                | a0                              | None                                  |
| 0101                                | a0                              | GPR[7]                                |
| 0110                                | a0                              | GPR[6], GPR[7]                        |
| 0111                                | a0                              | GPR[5], GPR[6], GPR[7]                |
| 1000                                | a0, a1                          | None                                  |
| 1001                                | a0, a1                          | GPR[7]                                |
| 1010                                | a0, a1                          | GPR[6], GPR[7]                        |
| 1100                                | a0, a1, a2                      | None                                  |
| 1101                                | a0, a1, a2                      | GPR[7]                                |
| 1110                                | a0, a1, a2, a3                  | None                                  |
| 1111                                | Reserved                        | Reserved                              |

FIG. 7



## EXTENDED SAVE INSTRUCTION

```

temp ← GPR[29]
temp2 ← GPR[29]
case args of
    2#0000 2#0001 2#0010 2#0011 2#1011: args ← 0
    2#0100 2#0101 2#0110 2#0111: args ← 1
    2#1000 2#1001 2#1010: args ← 2
    2#1100 2#1101: args ← 3
    2#1110: args ← 4
    otherwise: UNPREDICTABLE
endcase
if args > 0 then
    VirtualMemory[temp] ← GPR[4]
    if args > 1 then
        VirtualMemory[temp + 4] ← GPR[5]
        if args > 2 then
            VirtualMemory[temp + 8] ← GPR[6]
            if args > 3 then
                VirtualMemory[temp + 12] ← GPR[7]
            endif
        endif
    endif
endif
if ra = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[31]
endif
if xsregs > 0 then
    if xsregs > 1 then
        if xsregs > 2 then
            if xsregs > 3 then
                if xsregs > 4 then
                    if xsregs > 5 then
                        if xsregs > 6 then
                            temp ← temp - 4
                            VirtualMemory[temp] ← GPR[30]
                        endif
                        temp ← temp - 4
                        VirtualMemory[temp] ← GPR[23]
                    endif
                    temp ← temp - 4
                    VirtualMemory[temp] ← GPR[22]
                endif
                temp ← temp - 4
                VirtualMemory[temp] ← GPR[21]
            endif
        endif
    endif
endif

```

FIG. 8A

# EXTENDED SAVE INSTRUCTION

```

temp ← temp - 4
    VirtualMemory[temp] ← GPR[20]
    endif
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[19]
    endif
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[18]
endif
if s1 = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[17]
endif
if s0 = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[16]
endif
case args of
    2#0000 2#0100 2#1000 2#1100 2#1110: astatic ← 0
    2#0001 2#0101 2#1001 2#1101: astatic ← 1
    2#0010 2#0110 2#1010: astatic ← 2
    2#0011 2#0111: astatic ← 3
    2#1011: astatic ← 4
    otherwise: UNPREDICTABLE
endcase
if astatic > 0 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[7]
    if astatic > 1 then
        temp ← temp - 4
        VirtualMemory[temp] ← GPR[6]
        if astatic > 2 then
            temp ← temp - 4
            VirtualMemory[temp] ← GPR[5]
            if astatic > 3 then
                temp ← temp - 4
                VirtualMemory[temp] ← GPR[4]
            endif
        endif
    endif
endif
endif
temp ← temp2 - (0 || (framesize << 3))
GPR[29] ← temp

```

FIG. 8B

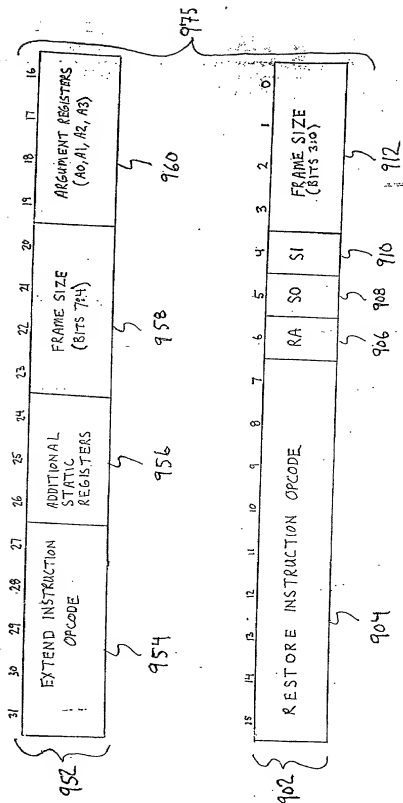


FIG. 9

METHOD FOR RESTORING REGISTERS AND DEALLOCATING  
MEMORY BEFORE EXIT FROM A SUBROUTINE

1000

SPECIFY AT LEAST ONE REGISTER OF A PROCESSOR CORE AS AN  
ARGUMENT REGISTER

1002

1001

SPECIFY AT LEAST ONE REGISTER OF THE PROCESSOR CORE AS A  
STATIC REGISTER

1004

SPECIFY A REGISTER OF THE PROCESSOR CORE AS A STACK  
POINTER REGISTER

1006

SPECIFY A REGISTER OF THE PROCESSOR CORE AS A RETURN  
ADDRESS REGISTER

1008

ENCODE IN AT LEAST ONE STATIC REGISTER FIELD OF AN  
INSTRUCTION WHETHER A VALUE IN MEMORY IS TO BE ~~SAVED~~ TO  
THE AT LEAST ONE STATIC REGISTER

1010

1009

A

FIG 10A

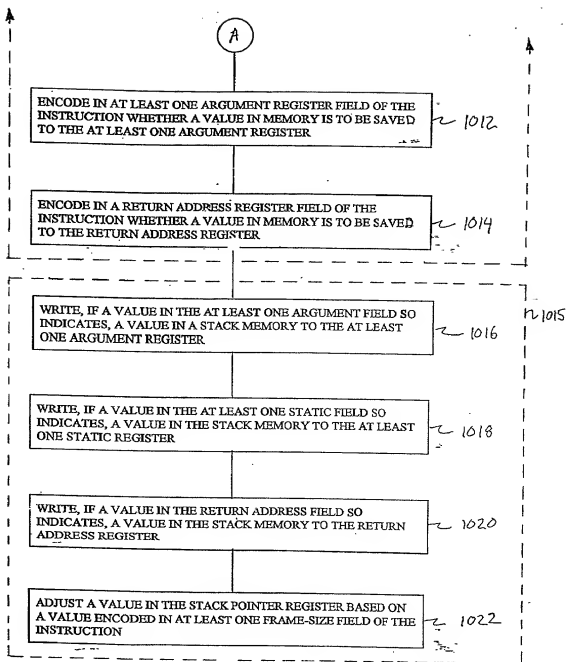


FIG. 10B

1100

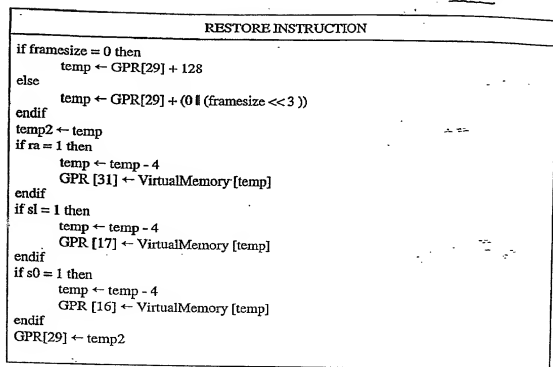


FIG. 11

1200

## EXTENDED RESTORE INSTRUCTION

```

temp ← GPR[29] + (0 || (framesize << 3))
temp2 ← temp
if ra = 1 then
    temp ← temp - 4
    GPR[31] ← VirtualMemory[temp]
endif
if xsregs > 0 then
    if xsregs > 1 then
        if xsregs > 2 then
            if xsregs > 3 then
                if xsregs > 4 then
                    if xsregs > 5 then
                        if xsregs > 6 then
                            temp ← temp - 4
                            GPR[30] ← VirtualMemory[temp]
                        endif
                        temp ← temp - 4
                        GPR[23] ← VirtualMemory[temp]
                    endif
                    temp ← temp - 4
                    GPR[22] ← VirtualMemory[temp]
                endif
                temp ← temp - 4
                GPR[21] ← VirtualMemory[temp]
            endif
            temp ← temp - 4
            GPR[20] ← VirtualMemory[temp]
        endif
        temp ← temp - 4
        GPR[19] ← VirtualMemory[temp]
    endif
    temp ← temp - 4
    GPR[18] ← VirtualMemory[temp]
endif

```

FIG. 12A

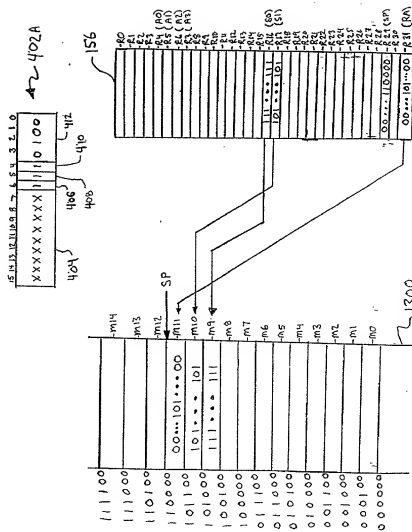
# EXTENDED RESTORE INSTRUCTION

```

if s1 = 1 then
    temp ← temp - 4
    GPR[17] ← VirtualMemory [temp]
endif
if s0 = 1 then
    temp ← temp - 4
    GPR[16] ← VirtualMemory [temp]
endif
case args of
    2#0000 2#0100 2#1000 2#1100 2#1110: astatic ← 0
    2#0001 2#0101 2#1001 2#1101: astatic ← 1
    2#0010 2#0110 2#1010: astatic ← 2
    2#0011 2#0111: astatic ← 3
    2#1011: astatic ← 4
    otherwise: UNPREDICTABLE
endcase
if astatic > 0 then
    temp ← temp - 4
    GPR[7] ← VirtualMemory [temp]
    if astatic > 1 then
        temp ← temp - 4
        GPR[6] ← VirtualMemory [temp]
        if astatic > 2 then
            temp ← temp - 4
            GPR[5] ← VirtualMemory [temp]
            if astatic > 3 then
                temp ← temp - 4
                GPR[4] ← VirtualMemory [temp]
            endif
        endif
    endif
endif
endif
GPR[29] ← temp2
    
```

FIG. 12B





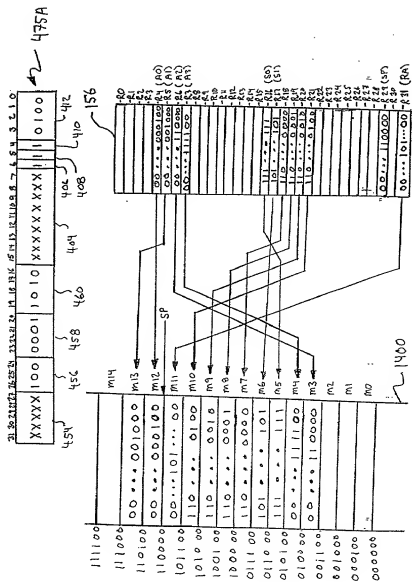
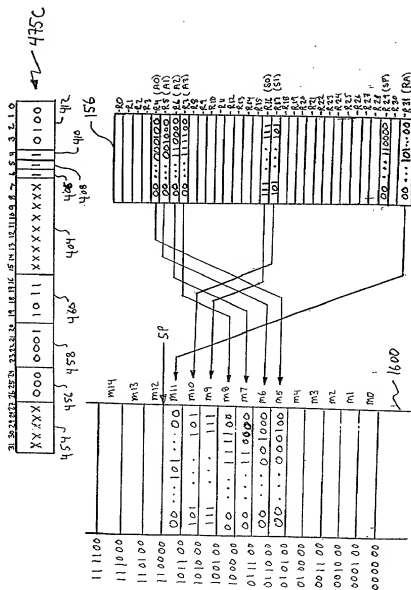
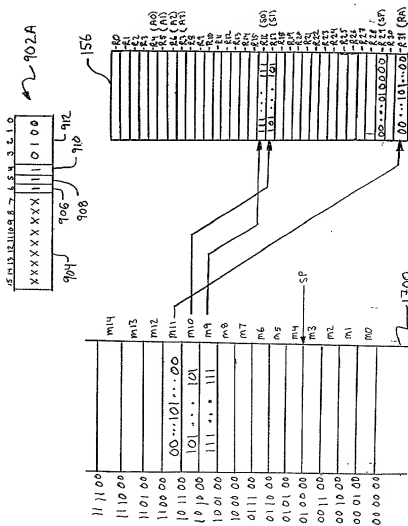


FIG. 14



FIG. 15





F16.18